

Appl. No. 10/630,746
Amendment dated: May 17, 2006
Reply to OA of: January 17, 2006

REMARKS

Applicants have amended the claims to more particularly define the invention by amending claim 1 to add the further limitation that at least one of the air cavities is formed from a first surface of the second ceramic layer to a second surface thereof, the first surface being in contact with the first ceramic layer and the second surface being in contact with the third ceramic layer. This limitation is supported by the specification as originally filed, including the drawings as would be appreciated by one of ordinary skill in the art to which the invention pertains; see pages 8-10. Applicants most respectfully submit that all of the claims now present in the application are in full compliance with 35 USC 112 and are clearly patentable over the references of record.

The rejection of claims 1, 3 and 4 under 35 U.S.C. 103(a) as being unpatentable over Yamada et al. in view of Wakino et al. has been carefully considered but is most respectfully traversed in view of the amendment to claim 1 and the following comments.

Applicants wish to note that the Yamada et al. reference is identified as U.S. Patent 6,784,762 throughout the written rejections. However, this appears to be a typographical error since the inventorship on this patent number is not Yamada et al. The Yamada et al patent identified in the attached PTO Form 892 to the Official Action is listed as U.S. Patent 6,784,765. This appears to be the correctly identified Yamada et al patent which is referred to in the rejections and as identified on the PTO Form 892. Therefore this response is made with respect to the '765 patent and not the '762 referred to in the written rejections.

At the outset, applicants wish to direct the Examiner's attention to the basic requirements of a prima facie case of obviousness as set forth in the MPEP § 2143. This section states that to establish a prima facie case of obviousness, three basic criteria first must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second,

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there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Section 2143.03 states that all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Applicants also most respectfully direct the Examiner's attention to MPEP § 2144.08 (page 2100-114) wherein it is stated that Office personnel should consider all rebuttal argument and evidence presented by applicant and the citation of In re Soni for error in not considering evidence presented in the specification.

In the Official Action it is urged that Yamada et al. teaches a multilayer ceramic circuit board with metal pattern conductive layers on different layers that overlap and a thermosetting resin layer between upper and lower metal patterned ceramic layers that has a lower dielectric constant layer than either of the upper or lower ceramic layers in order to provide better isolation of the layers when operating in the RF frequency band.

It is then urged that the Wakino et al. reference teaches using a ceramic layer with porous cavities between upper and lower ceramic layers with circuit patterns in order to provide a low dielectric constant to prevent interaction of the circuit layers.

It is concluded in the Official Action that it would have been obvious to one of ordinary skill in the art to have used a ceramic middle layer with cavities instead of a thermosetting resin layer to have a lower dielectric constant layer between metal circuit layers in order to prevent interaction of the circuits and allow formation of the circuit layers with co-firing and no adhesive step because of the teachings of Wakino et al.

This aspect of the rejection has been carefully considered but is most respectfully traversed.

As now amended, the invention as defined in the amended claim 1, claims a multilayer RF module which includes a plurality of vertically stacked ceramic layers including a first to a third ceramic layers, wherein each of the first and the third ceramic layers has a circuit component thereon and the second ceramic layer is located between the first and the third ceramic layers and provided with at least one or more air cavities filled with air. Each of the air cavities is vertically aligned with the circuit components of the first and the third ceramic layers, and is formed from a first surface of the second ceramic layer to a second surface thereof. The first surface of the second ceramic layer is in contact with the first ceramic layer; and the second surface thereof is in contact with the third ceramic layer. By forming the air cavities having low dielectric constant in the multilayer RF module, dielectric loss in transmission lines of RF module is significantly reduced. Further, the generation of parasitic capacitance in circuit components is also markedly reduced, thereby improving the passive element properties. Accordingly, by reducing the interference, the interconnect density of a multilayer RF module is greatly enhanced.

In contrast, Yamada discloses a multilayer ceramic RF device including two ceramic layers 14 and 15 having multilayer circuit patterns, respectively, wherein dielectric constants of the two ceramic layers 14 and 15 are different from each other. To solve the problem of generation of the parasitic capacitance between the two ceramic layers 14 and 15 having different dielectric constants, Yamada provides a thermosetting adhesive resin 17 with low dielectric constant between the two ceramic layers. Accordingly, Yamada does not disclose or suggest the ceramic layer having one or more air cavities as defined in the presently claimed invention.

Further, Wakino discloses a multilayer printed circuit board having a stack of insulating layers. In Wakino, a layered space 7 is provided in the intermediate insulating layer. However, the layered space 7 is formed in only a lower part of the intermediate insulating layer. Accordingly, Wakino does not disclose or suggest that a cavity is

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formed from an upper surface of a ceramic layer to a lower surface thereof. Moreover, the necessary motivation to modify the references is not contained in the prior art and Applicants' specification may not be used as a teaching reference. In re Fritch, 23 USPQ 1780, 1784(Fed Cir. 1992) ("It is impermissible to engage in hindsight reconstruction of the claimed invention, using the applicant's structure as a template and selecting elements from references to fill the gaps.).

Accordingly, although combining a multilayer ceramic RF device of Yamada with the intermediate insulating layer of Wakino, the combination is different and unobvious from the multilayer RF module of the presently claimed invention. Therefore, it is most respectfully requested that this rejection be withdrawn.

The rejection of claim 2 under 35 U.S.C. 103(a) as being unpatentable over Yamada et al. in view of Wakino et al. as applied in the rejection of claims 1, 3, and 4 and further in view of Sreeram et al. has been carefully considered but is most respectfully traversed for the above reasons and further in view of the amendment to claim 1.

It is urged that Sreeram et al. teaches the formation of holes in ceramic layers by punching through a green sheet, that may be different shapes that may have diameters, and may form internal or buried cavities. It is urged that it would have been obvious to one of ordinary skill in the art to use cylindrical cavities instead of fine pores in the middle of low dielectric constant in view of Yamada et al. and Wakino et al. in order to form the cavities by an alternate process that uses punching instead of burning out an organic substance. This rejection is respectfully traversed in view of the amendments to the claims and that the teachings of the Sreeram et al. reference do not overcome the deficiencies in the primary references as discussed above. Accordingly, it is most respectfully requested that this rejection be withdrawn.

The provisional rejection on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over claims 7-9 of copending Application No. 10/872,429 has been noted. The '429 application has been refiled as a divisional


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application and applicants most respectfully submit that the provisional rejection is now moot and will be dealt with in the refiled application.

As noted by the Examiner, this is a provisional rejection since the allegedly conflicting claims have not in fact been patented. It is most respectfully requested that the provisional rejection be withdrawn upon allowance of the present application and appropriate action taken in the divisional of the '429 application at the appropriate time. Applicants make no admission as to the propriety of the obviousness-type double patenting rejection and reserve all options to argue against it before filing a terminal disclaimer in the related case.

In view of the above comments and further amendments to the claims, favorable reconsideration and allowance of all the claims now present in the application are most respectfully requested.

Respectfully submitted,
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